Floor-treatment machine

The present invention relates to a floor-treatment machine with an undercarriage and at least one positionally adjustable floor-treatment unit, which is attached to the undercarriage in such a way that it can pivot around a substantially vertical axis in order to vary the working width.

Such floor-treatment machines with variable working width are known in particular in the art of floor cleaning (see, for example, European Patent 0569430 B1 and US Patent 3345671 A). By comparison with floor-treatment machines with constant working width, such variable working width is supposed to increase the flexibility of use of the floor-treatment machine in question, in that it can be used equally well for treatment of expansive areas and of narrow areas.

A disadvantage of conventional floor-treatment machines of the class in question, with variable working width, is that, in the vicinity of obstructions at which the working width is temporarily reduced, areas not swept over by the positionally adjustable floor-treatment unit remain untreated. Furthermore, known floor-treatment machines are difficult to manipulate during floor treatment in "dead ends" which necessitate reversal of the working direction, especially if an adjustment of working width is required because of obstructions.

The object of the present invention is to provide a floor-treatment machine of the class in question which does not suffer from the foregoing disadvantages.

According to the present invention, this object is achieved in that the at least one positionally adjustable floor-treatment unit can be pivoted in two directions from its position corresponding to the maximum working width in order to reduce the working width. Whereas in known floor-treatment machines of the class in question, the at least one positionally adjustable floor-treatment unit can be pivoted either only toward the front or only toward the rear from its position corresponding to the maximum working width in order to reduce the working width, the inventive design of the floor-treatment machine permits pivoting of the at least one positionally adjustable floor-treatment unit in two directions from its position corresponding to the maximum working width, and in particular both toward the front and toward the rear. This has the effect in particular that the positionally adjustable floor-treatment unit, upon encountering an obstruction which restricts the working width, can automatically pivot, regardless of the working direction of the floor-treatment machine at the time, toward the rear or else toward the front (relative to the floor-treatment machine), depending on whether the floor-treatment machine is moving in the main working direction or opposite thereto at the time. In addition, the inventive attachment of the at least one positionally adjustable floor-treatment unit permits floor treatment very largely without dead spaces.

According to a preferred improvement of the invention, the positionally adjustable floor-treatment unit, when in its

position corresponding to the maximum working width, extends perpendicular to the working direction. This permits a particularly simple technical and structural design of the attachment. According to a further preferred improvement of the invention, the at least one positionally adjustable floor-treatment unit is held in its position corresponding to the maximum working width by means of a spring device that applies an initial force, and it can be deflected in both directions from this position counter to the force of the spring device. This improvement is advantageous in particular because of the fact that it permits automatic adaptation of the working width to the local conditions existing at any given time, and does so regardless of the working direction of the floor-treatment machine at the time.

Yet another preferred improvement of the invention is characterized in that the at least one positionally adjustable floor-treatment unit is attached to the undercarriage in such a way that it can be displaced linearly in addition to its pivoting capability. In a particularly preferred embodiment, such linear displacement of the at least one positionally adjustable floor-treatment unit takes place perpendicular to the working direction. Such a design of the attachment of the positionally adjustable floor-treatment unit further reduces the dead space during floor treatment around obstructions, especially if the area to be treated has particularly complex shape. In particular, the positionally adjustable floor-treatment unit can be used in narrow recesses and similar places, by the fact that there it is extended laterally from and retracted back into the undercarriage. In a most particularly advantageous embodiment in this

connection, the at least one positionally adjustable floor-treatment unit is disposed on the front rim of the undercarriage (relative to the main working direction). In this case, therefore, the positionally adjustable floor-treatment unit can also be used for floor treatment at its front end, especially in "dead ends".

For linear displacement of the positionally adjustable floor-treatment unit used in the improvement of the invention described in the foregoing, there is expediently provided a drive unit, for example of hydraulic or pneumatic type. In addition to manual control thereof, automatic control is possible by the fact that there is provided, in the front part of the floor-treatment machine, a proximity switch or touch contact which acts on the controller of the drive unit for the at least one positionally adjustable floor-treatment unit, specifically in such a way that, upon actuation of the proximity switch or touch contact, especially when the floor-treatment machine runs up against the end wall of a "dead end", the positionally adjustable floor-treatment units are retracted in order to reduce the working width. This is applicable in particular, as will be explained hereinafter, for sweeping machines, in which the positionally adjustable floor-treatment units are designed as sweeping units comprising revolving endless sweeping belts.

If, within the foregoing meaning, the inventive floor-treatment machine is a floor-cleaning machine whose positionally adjustable sweeping unit comprises a revolving endless sweeping belt, in yet another preferred improvement of the invention the direction of revolution of the endless sweeping belt is reversible. Such reversibility of the

direction of revolution of the endless sweeping belt proves to be particularly advantageous in connection with the equal quality of floor cleaning in the main working direction and in the opposite direction permitted by the invention. In this case the floor can be cleaned particularly effectively around obstructions by means of the revolving endless sweeping belt. A particularly preferred improvement of the invention in this connection is characterized in that the direction of revolution of the endless sweeping belt is automatically reversed upon reversal of the working direction.

A further advantageous improvement of the invention also relates to floor-treatment machines designed as floor-cleaning machines, wherein a positionally adjustable sweeping unit is provided in the form of a rotary brush. The bristle array can then extend in the form of a helical coil around a central roller member. Consequently, given appropriate direction of rotation of the rotary brush, the sweepings are conveyed in inward direction. This favors a constant cleaning effect even for rotary brushes pivoted - within certain limits - toward the front or toward the rear.

The scope of application of the present invention is extremely broad. In particular, floor-cleaning machines of any type can be designed according to the present invention, examples being sweeping machines, scrubbing machines, suction machines, suction and blowing machines as well as machines for pushing or clearing away solid, liquid and semifluid contaminants. In the art of sweeping machines, the present invention can be used regardless of whether the positionally adjustable sweeping unit comprises

a revolving endless sweeping belt, one or more rotary brushes, one or more circular brushes, a helical sweeper or a sweeping element driven in some other manner. The present invention can also be used in floor-sanding machines. The same is true for machines for sprinkling the floor with water, disinfectants or similar substances. The present invention is equally usable for indoor and outdoor applications.

The present invention will be explained in more detail hereinafter by means of a practical example which illustrates the implementation of the invention on a sweeping machine and which is presented in the drawing, wherein

Fig. 1 shows a top view of a positionally adjustable sweeping unit disposed on the front right corner of a sweeping machine, which in all other respects is of conventional design and therefore is not illustrated;

Fig. 2 is a partial view from below, corresponding to Fig. 1; and

Fig. 3 shows schematically, in a view from below, a particularly advantageous embodiment of a sweeping unit designed as a rotary brush.

The sweeping machine comprises in a manner known as such an undercarriage 1, which is supported via wheels on the floor. Of those wheels, there is illustrated wheel 2, which is disposed centrally in the front region and which comprises a castor 5 mounted in a steering-castor frame 4 mounted pivotally around a vertical axis 3. In undercarriage 1 there is rotatably mounted a sweeping

roller 7 driven in rotation around a horizontal axis 6. As viewed in the main working direction (arrow A), there is provided behind main sweeping roller 7 a dirt-collecting container 8, into which refuse is conveyed by main sweeping roller 7 through opening 9 provided between this and dirt-collecting container 8. To this extent the design of the sweeping machine corresponds to the prior art, and so further explanation is unnecessary.

At the front right corner of undercarriage 1 there is provided a frame 10 for a positionally adjustable sweeping unit 11. This frame 10 comprises two portions joined to one another in articulated manner, the first being an inner portion 12 joined rigidly to undercarriage 1 and the second being an outer portion 13, which is joined to inner portion 12 of frame 10 in articulated manner such that it can pivot around a horizontal axis 14 running parallel to main working direction A. Positionally adjustable sweeping unit 11 is mounted on outer portion 13 of frame 10, and so, by virtue of the articulated joint explained in the foregoing, the inclination of sweeping unit 11 can be varied, for example in order to clean ramps.

Positionally adjustable sweeping unit 11 comprises an endless sweeping belt 15 in the form of a link chain, wherein the individual chain links are provided with a bristle array 16. Link chain 15 is guided around two deflection wheels 17 and 18, which in turn are rotatably mounted in a sweeping-belt frame 19.

Sweeping-belt frame 19 is mounted pivotally around axis 20 on outer portion 13 of frame 10, in such a way that sweeping-belt frame 19 can be pivoted around axis 20 both

toward the front (arrow B) and toward the rear (arrow C). By means of a spring device - which is not illustrated - the sweeping-belt frame is held by initial force in its position which corresponds to the maximum working width, and which as illustrated in the drawing extends perpendicular to working direction A. From this position, sweeping unit 11 can be pivoted both toward the front (arrow B) and toward the rear (arrow C), against a restoring force exerted by the said spring device.

Sweeping-belt frame 19 is provided on its upper side with a linear guide 21. A mating piece which is part of the attachment of sweeping unit 11 to frame 10 is joined to this linear guide. By linear displacement of sweeping-belt frame 19 in the said mating piece, sweeping unit 11 can be displaced linearly toward the inside (arrow D), in addition to its pivoting capability. An intermediate position is illustrated with broken lines.

Since the type of drive for sweeping belt 15 is not pertinent in connection with the present invention, a diagram thereof is not necessary. The drive can be designed in any way known as such, especially by means of a separate motor disposed on sweeping-belt frame 19, and also by transmission from a central drive by means of a conventional transmission device. Similarly, such a central drive can be a motor as well as a frictional wheel driven by the motion of the sweeping machine.

At the front end of undercarriage 1 there is disposed a proximity sensor 22. This responds as soon as the sweeping machine has been guided so close to a wall, step or the

like that the front strand of sweeping device 11 is sweeping directly at the wall or step. In this case proximity switch 22 acts on a drive unit, which is not illustrated, but which displaces sweeping unit 11 linearly toward the inside (arrow D). In this way, the strip between the front wall of the sweeping machine and the opposite wall or step is also swept.

The direction of revolution of sweeping belt 15 is adjustable (double arrow E). In this way it can be ensured that, during sweeping in main working direction A, the front strand of sweeping belt 15 sweeps inward and feeds the dirt to main sweeping roller 7; during operation of the sweeping machine counter to main sweeping direction A, sweeping belt 15 reverses its direction of revolution, and so its rear strand sweeps inward and feeds the dirt inward, where it can be picked up by main sweeping roller 7 as it travels over the strip in question once again. Such double travel over the strip to be cleaned can be prevented if necessary if sweeping unit 11 conveys the dirt in question between two main sweeping rollers, so that the dirt is fed by sweeping unit 11 to one of the two main sweeping rollers during operation in the main working direction and also in the direction opposite thereto. Alternatively there can be used an additional vacuuming device, whose intake opening is disposed especially in the immediate vicinity of the corner in question of the undercarriage, as is illustrated at 23. The vacuuming device in question has to be turned on only during operation of the sweeping machine counter to the main working direction; nevertheless, to assist the sweeping effect, it can also be turned on continuously,

further intake openings being provided at intervals over the working width.

Fig. 3 illustrates, in a view from underneath, the embodiment of positionally adjustable sweeping unit 11 as a rotary brush 24, which is driven rotatably (arrow F) around axis 25. Rotary brush 24 comprises a cylindrical central roller member 26 and a bristle array 27, which extends in the form of a helical coil around central roller member 26. When rotary brush 24 is driven in the illustrated direction of rotation (arrow F), helical bristle array 27 exerts an inwardly directed transport component (arrow G) on sweepings 28 located in front of rotary brush 24 in working direction A, so that sweepings 28 are fed to a central main sweeping roller 7 even when - as illustrated - rotary brush 24 is inclined toward the rear, counter to working direction A.

Rotary brush 24 is attached to undercarriage 1 such that it can pivot around axis 29. It can be pivoted both toward the front (arrow B) and toward the rear (arrow C) from its position disposed perpendicular to working direction A.